USER MANUAL

EA915*X* Digitale telefoon hybride

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Preface.

WARNING

Do not expose the Digital hybrid to rain or high humid environments, to avoid danger of fire or electric shock. To reduce the risk of electrical shock, do not remove covers (or back) when unit is powered up. No user-servicable parts inside. Refer for servicing to qualified service personnel only. Modification or servicing by unqualified personnel will void the warranty. Avoid exposure of the Digital hybrid to bright sunlight, high temperatures and dust.

CE-PRODUCT

The Digital hybrid complies with the requirements of the 'New Approach" Directives as they are pointed out by the EEC. The CE mark can be found on the back of the unit.

CE

The **EA915X** has not been approved to be connected to the direct telephone line and must therefore, due to the requirements of the telephone provider be connected only through an in-house telephone exchange (pseudo-terminal equipment). Direct connection to the public telephone net is under sole responsibility of the user.

This product can only be used for the purpose, the installation and the environment as described in this manual. The manufacturer does not take any responsibility for applications and handling which are not conform to these descriptions.

MAINTANANCE

Clean the outside of the unit, when necessary, with a soft perhaps only light damped cloth. Do not use any detergents like alcohol, ammonia or white spirit to clean the unit. This could damage the surface.

WASTE DISPOSAL!

The equipment and its packing material should ultimately be disposed off in accordance with the applicable (environmental) regulations, or the unit can be returned to the dealer or manufacturer.

" Do not dispose the Digital hybrid with the normal household waste. "

For ease of reading, all commonly known technical terms are used in the text as they are; a glossary is added in the back of this manual.

Purpose.

The main purpose of the EA915X is to be used as an interface to make a connection between a telephone line and a mixing console, with the highest possible quality and reliability. To obtain this purpose, the EA915X uses a Digital Signal Processor which reduces the crosstalk, normally existing in a hybrid circuitry, to a minimum.

Realisation.

To realise this purpose, a design has been set up with a by **TELEFICATION** successfully tested and approved hybrid circuitry from the EA815/1 (analogue hybrid) and attached to it a 16-bit **D**igital **S**ignal **P**rocessor of Analog Devices and a 16-bit Codec of Crystal together forming the heart of the digital echo canceller. FLASH technology is used for permanent storage of the settings for the echo canceller. A microprocessor takes care of the internal and external control.

Installation.

Check the equipment for any transport damage after unpacking.
Before installation and taking the unit into service, please read this manual.
Make sure the unit will be installed in any equipment bay with sufficient unobstructed air circulation so that the maximum air temperature in the equipment environment will not be exceeded.
Before mounting the EA915X into a 19" rack, the user should make some settings which are dependent on the use of the unit and its infrastructure. These settings can be done over 4 DIL switches which are reachable on the rear of the unit. Make sure the power is not connected (yet) when adjusting the switches.

DILSWITCH SETTINGS.

DIL SWITCH SETTINGS			
CALL	**CALL**	**CALL+READY**	
1	**ON**	**OFF**	
REMOTE ON/OFF	**CONTINUE**	**PULSE**	
4	**ON**	**OFF**	
CANCELATION	**CONTINUE**	**MANUAL**	**STORE**
2	**ON**	**OFF**	**ON**
3	**OFF**	**OFF/ON**	**ON**

Remark: Standard factory settings are marked in grey.

DILSWITCH 1.

With this dilswitch the behaviour of the RING-output (Opto-isolator) is set. In the ON-position this RING-output can be used as indication of an incoming call.
In the OFF-position the output can be used for signalling of an incoming call as well as indication of the ON/OFF status of the hybrid. This RING-output can be found on the 9 pin D-type connector marked IN/OUT/REMOTE.

DILSWITCH 2 & 3.

With these dilswitches the behaviour of the automatic control for the minimum hybrid crosstalk is set. Dependant of the application the best automatic control method can be selected.

DILSW2	DILSW3	CROSSTALK SETTINGS (CANCELLATION)
OFF OFF	OFF ON	After switching the hybrid on, the automatic adjustment is active for approx. 2 seconds. After that, the adjustment can be repeated by pressing the UPDATE switch..
ON	OFF	After switching the hybrid on, the automatic adjustment is continously active. By pressing the UPDATE switch this adjustment process can be toggled OFF or ON.
ON	ON	After switching the hybrid on, the adjustment parameters used are those which are obtained from a previous adjustment procedure and stored in the memory. By pressing the UPDATE switch, the unit tries to find a new optimum setting; at releasing the UPDATE switch these new parameters are stored in the memory.

Making the correct setting.

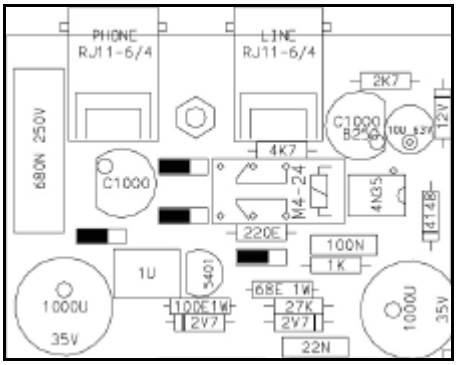
The most user friendly dilswitch setting is the last one mentioned (DILSW2 = On & DILSW3 = On), because the digital echo-canceller adjustment doesn't have to be realigned after the unit is switched on. This has the advantage that the hybrid can be used to go on air direct, without the need for a producer or operator to have a pre-conversation in which this adjustment for minimum hybrid crosstalk has to be performed. This method can only be used if the condition of the lines from the hybrid in the studio to the first (in house) telephone exchange are the same. This means this can be used with any stationary hybrid in a studio or studio complex in which above mentioned conditions are the same because the lines used are the same.
If for some reason this method does not give satisfactory results, the dilswitch settings according the first method then can be used (DILSW2 = Off & DILSW3 = Off).
The hybrid will after it has been switched on during a short time (approx. 20 seconds) adjust itself. In some cases this adjustment can be found not good enough. The auto-adjustment then can be activated again by pressing the UPDATE switch for 20 seconds. The hybrid crosstalk (cancellation) will then be adjusted until a minimum is reached.

DILSWITCH 4.

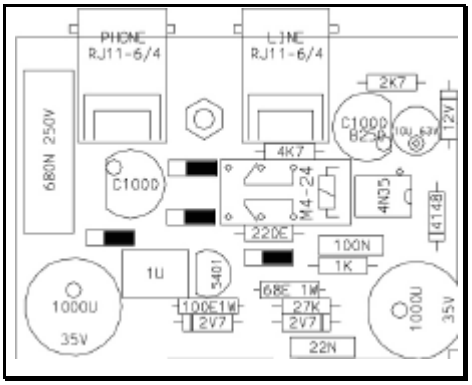
With this dilswitch the behaviour of the EXTERNAL-ON input can be set. In the ON-position the hybrid can be switched ON remotely by means of a **continuous** closing (loop) contact. In the OFF-position the hybrid can be toggled On and OFF by a remote **pulse** contact. This EXTERNAL-ON input can be found on the 25 pin D-type connector marked EXT_ON.

Voltageless lines.

In some occasions (some in-house telephone exchanges) the telephone line does not carry any voltage for the extensions. Within the hybrid you can find 4 jumpers with which its telephone circuit can be adapted to this different application regarding these telephone lines. The factory setting for these jumpers is in the position for the hybrid to be used on normal telephone lines (carrying linevoltage). **NEVER** use the setting for the voltageless lines on a normal telephone line which does carry a voltage, because this could seriously **DAMAGE** the hybrid. In the drawings below, both settings are shown.



Line set as normal telephone line



Line set as voltageless input

Use 2 or 4 Wire mode in EELA AUDIO consoles ?

Because of the excellent low hybrid crosstalk, the telephone module in the EELA AUDIO mixing consoles can be set in the 4W mode (dilswitch position or central processor setting). This means talking into the return output of the mixing console to the hybrid (and to the caller) is no longer blocked when the fader is open and the hybrid is on air.

Connections.

Adjustment of the DIL switches can be done on the rear side of the unit. The following other connections can be found on the back side of the unit.

Power.

To this inlet the seperate mainsplug power supply (2x18V-AC) has to be connected.
Use only the power supply included in the delivery; check for the correct mains voltage.

Receive.
This is the signal coming from the caller so being the output of the hybrid. This signal should be fed into the input of an audio mixing console.

Send.
This is the signal to be sent to the caller and is the input signal for the hybrid. This signal comes from a (clean feed) output of the audio mixing console.

Line.
Connection for the telephone line.

Phone.
Connection for a normal telephone set to which the line is looped when the hybrid is off. This allows the user to dial a connection, have a pre-conversation with a caller or answer an incoming call.

In/Out/Remote.
On this connector the control inputs and outputs can be found for remote control. Apart from on the XLR's, the receive and send signals also can be found here, thus enabling the hybrid to be connected to an EELA AUDIO mixing desk using one multicore cable. The EA915x can be used with Eela Audio mixing consoles. With the Logos mixing console, a 1 to 1 (1:1) cable can be used.
The ADAPT signal has the same functionality as the UPDATE button on the front side of the hybrid.

PIN NR	SIGNAL	REMARKS
PIN 1	CH.GND	Chassis ground, meant for the cable screen.
PIN 2	RECEIVE+	In-phase signal of receive output.
PIN 3	RECEIVE+	In-phase signal of receive output.
PIN 4	L+	In-phase SEND signal (left).
PIN 5	R+	In-phase SEND signal (right).
PIN 6	EXT_ON	With a connection to GND, the unit can be switched on.
PIN 7	ADAPT_EXT	With a connection to GND, the unit can be updated (see UPDATE button)
PIN 10	RING+	Ring optocoupler output (colector) for external signalling
PIN 14	RECEIVE-	Out-of-phase signal of receive output.
PIN 15	RECEIVE-	Out-of-phase signal of receive output.
PIN 16	L-	Out-of-phase SEND signal (left).
PIN 17	R-	Out-of-phase SEND signal (right).
PIN 18	GND	Ground for EXT_ON input.
PIN 19	GND	Ground for ADAPT_EXT output.
PIN 22	RING-	Ring optocoupler output (emitter) for external signalling.

Alignment hybrid.
When all settings and connections are made, the level and balance of the hybrid have to be adjusted to be able to get the most optimal result. Use a screwdriver with a not to small blade in order not to damage the slot of the trimpots.

Send level.

The hybrid is set out in such a way that when putting the SND control in the centre position the nominal input level of the SEND input is set to +6dBm. The adjustment range of the SND control is + en -12 dB with reference to this nominal level. The send level has to be aligned as follows:
Apply to the hybrid input by means of the controls of the mixing console a nominal signal. Now activate the hybrid by pressing the HYBRID_ON switch. Adjust by means of the SND control the level in such a way that only the peaks occurring in the signal make the LIM-led go on. Convince yourself of the fact that a continuos overloading limiter gives a poor result for the signal to the caller, whereas a limiter handling an occasional peak sounds good. Now the send level has been set correct and the hybrid can be switched off.

Receive level.

Make sure there is NO send level present at alignment of the receive level. The hybrid is set out in such a way that when the RCV control is placed in the centre position the output level is set to +6dBm with a signal present on the telephone line of -12 dBm. The control range of the RCV control is + and - 12 dB. It is important to align the receive level very accurate to make sure there is no overload on the input of the A/D converter. This results in a considerable and aggressive distortion of the receive signal. Because the level of the various telephone connections can vary, it is wise to test the maximum level by making several calls.
With the highest level found, the RCV control has to be set in such a way that this gives an output level of the hybrid to the mixing console (-input) of about +6 dBm. Again, do not give too much gain in this path to prevent overload of the electronics. It is easier for a too low signal to be corrected with the gain or the gain of the input channel of the mixing desk.

Adjustment of the hybrid damping (echo-cancelling).

The alignment of the hybrid circuitry is done by means of the R-bal and C-bal controls and ensures an minimal crosstalk in these analogue circuits before the digital echo canceller takes care of any residual unwanted signal. The best way to perform this alignment is by using a "pink noise" signal because it contains all frequencies with equal energy thus enabling a wideband adjustment. If no such signal is available, a wideband music passage can be chosen.
Now switch the hybrid in bypass mode by pressing the BYP-switch which is situated behind the frontpanel and can only be operated by inserting e.g. a small screwdriver through the hole in the frontpanel marked BYPASS. Judge the contribution of the (send) signal to the caller appearing because of the crosstalk in the receive signal. Subsequently use the R-bal and C-bal trimpots to adjust this contribution to a minimum.
Now switch off the bypass mode. By pressing the UPDATE switch the digital echo canceller will minimize the residual crosstalk. For getting the best result, it is important that, during the update procedure of the digital echo canceller, there is no receive signal present. This can be achieved by covering the receiver at the caller's end and asking the caller to be silent for some seconds. If the result is not satisfactory, the procedure for adjusting the R-bal and C-bal can be repeated, using another setting.
The hybrid is now completely aligned and ready for use.

Use.

The EELA AUDIO hybrid of course can be easily interfaced with all EELA AUDIO "telephone" modules from the S130, S340 and S440 series consoles: An incoming call is also indicated on the channel and the hybrid can be activated (diverted) from the channel.

In the S130 series, no Auto Answer and Ready indication is possible. In the S340 and S440 consoles, the software of this telephone channels also offers the possibility of Auto Answer.

Answering and ending a call.

An incoming call is indicated by means of a flashing LED on the front, when interfaced to a desk this flashing can be made visible there as well by means of the "external signalling" output on the hybrid's REMOTE connector. This call can be answered by either pressing the HYBRID ON switch on the front of the hybrid or remote (e.g. the mixer's channel ON/OFF button) again via interfacing EXT_ON on the REMOTE connector of the hybrid.
When interfaced to an EELA AUDIO desk, the auto-answer function of these desks will automatically activate the hybrid after 3 call-pulses.

Make sure the fader is closed in order not to have the caller on air directly. With this fader closed it is possible to have a pre-conversation using the TalkBack button on the channel and the PFL or COM possibility. If the hybrid crosstalk is found poor, the caller can be asked to be silent when performing the UPDATE procedure. Thus the digital echo canceller is re-adjusted. Now the telephone call can be brought on air by opening the fader. It is not possible to switch off the hybrid when the fader is open as a security not to loose a call when it is on air; first the fader has to be closed. When the fader is open it is not possible to use the TalkBack route to talk to the caller (unless in 4-wire mode); the caller can hear the program audio through the dedicated telephone return path.

Making a connection (outgoing call).

A connection to the caller can be established by means of an external telephoneset connected to the terminal marked "phone". Only when the hybrid is not activated this telephoneset is looped through to the telephone line. After the number has been dialled, the hybrid can be activated and the procedure can be followed as described above starting at "#Make sure the fader is closed...".

Technical specifications.

Technical specifications are valid under the following conditions:

- All controls in center position.
- 22Hz - 22kHz Bandwidth.
- 600 Ohms source and terminating impedance for line adjustments.
- Voltageless line input circuitry.
- Line (tel) input -12dBm, send input +6dBm, both @1kHz.

Send.

Send input sensitivity : - 6dBm ... +18dBm.
Send gain adjustment range : +/- 12dB.
Limiter threshold : +6 dBm.
Output noise : < -70 dBm.
Distortion : < -60dB.
Input impedance : 20 kOhm electronically balanced.
Input balance : <-40 dB.

Receive.

Receive output level : - 24dBm...0dBm.
Receive gain adjustment range : +/- 12dB.
Output noise : < -60 dB.
Distortion : < -60 dB.
Output impedance : <50 Ohms, transformer balanced.
Output balance : <-40dB.

General.

Line Impedance : 600 Ohms.
Maximum level to telephone line: -3dBm.
Distortion : < -50dB.
Hybrid damping: >40dB (average).
Dimensions : 19 Inch, 1U high, 155 mm (WxHxD).
Input : 18 Volts AC via included mains adapter.
Power consumption : 4 Watts.

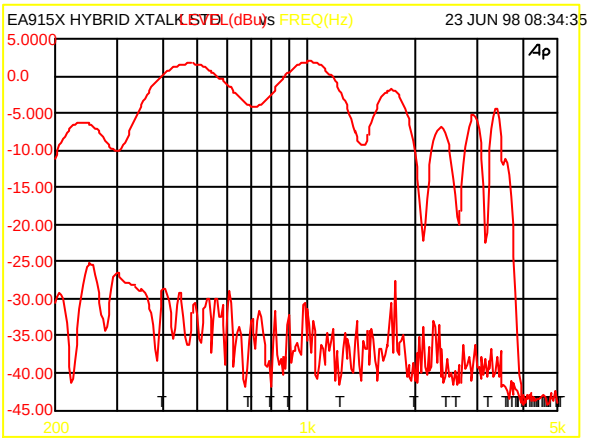


Fig.1

In fig1 the hybrid crosstalk is shown from a random connection. Note that every new test will give another result. The upper curve shows the crosstalk with the digital echo canceller switched off by means of the BYPASS switch; the lower curve shows the crosstalk with the digital circuitry active.
For reading of an absolute value on the dB axis, 9dB has to be subtracted because of the respectively 9dB attenuation in the send path and 18dB gain in the receive path.

Glossary.

DSP.

Stands for Digital Signal Processor. This is a processor, specially meant to perform digital calculations on analogue signals.

Hybrid.

Term used for the circuit to adapt a 2 wire telephone system to a so-called 4-wire (separate input and output) interface.

Telefication.

Organisation, in the Netherlands registered as Notified Body to give approvals to telecommunication equipment.

Codec.

Stands for short for a Coder / Decoder combination. Also often used as name for an A/D and D/A converter combined in 1 housing.

Echo-canceller.

System eliminating crosstalk in a hybrid circuit.

Ring.

Not audible call signal of the EA915X unit.

Cancel.

Term for eliminate or escape.

Flash.

Is a type of memory. This type of memory is re-writable and does not need a supply voltage to retain its data.

Update.

Is used to let the echo-canceller adapt itself to a new situation.

Dilswitch.

Miniature switch bank with which user specific settings can be made.

Hybrid crosstalk.

Crosstalk inherent to the hybrid circuitry and system in general.

Receive.

Signal received by the installation in the studio from an outside caller.

Send.

Signal sent out by the studio to the outside caller.

Limiter.

A limiter is a circuitry limiting the volume of an audio signal, thus making sure it does not exceeds a preset maximum.

A/D.
Is the abbreviation used to convert an Analog signal to the Digital domain.

Bypass.
Is to activate the situation where the digital echo canceller is not used (bypassed).

Auto answer.
Process of automatically answering an incoming call over the telephone.

TB.
Is the abbreviation used for **T**alk **B**ack.

Faults list.
Always make sure that the unit receives supply voltage.

Connection is lost at activating the hybrid.
If the connection is lost when switching the hybrid on and the CALL-led did indicate an incoming call in a normal way could indicate that the telephone line is connected to the "PHONE" terminal instead of the "LINE" terminal.

R-bal en C-bal alignment not satisfactory.
Jumpers are possibly set for use of the wrong line-type, or different line conditions such as extreme short or long lines.

Echo canceller does not respond.
If the echo canceller does not give extra damping, it is possible the hybrid still is in bypass mode.

Echo canceller does not give sufficient damping.
Try making another setting of the R-bal and C-bal trimpots. Subsequently try again to minimize the crosstalk using the UPDATE switch (Hold it for approx. 20 seconds).

Echo canceller setting does not stop after 2 seconds.
Continuous automatic adjustment is selected by means of dilswich setting.

Hybrid can not be switched off locally or remote.
Hybrid is switched ON externally and thus can not be switched OFF locally by means of its frontpanel switch or hybrid is switched ON locally by means of the frontpanel switch and thus can not be switched off remotely.

Unsufficient receive signal.
If this only occurs occasionally, the cause can be found in the caller or the line. If this is a continuos phenomena, the RCV control might not been aligned correct. If the signal does not contain any low frequencies, chances are that the balanced signal is not interfaced properly to a subsequent (unbalanced) input circuitry.

Insufficient send signal.
First of all make sure that the input signal of the hybrid is within the specifications mentioned so the mixing console gives sufficient output signal. If adjustment of the SND control still does not allow for enough signal present, this could mean that the drive from the output in front of the hybrid input is unbalanced.

Blockdiagram.